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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Harry Kirk Mathews Jr. et al.	§	Group Art Unit: 2636
Serial No.: 10/063,950	§	Examiner: Swarthout, Brent
Filed: May 29, 2002	§	
For: Method and Apparatus for Detecting Hot Rail Car Surfaces	§	Atty. Docket: GERD:0374/YOD 124463-2

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37 C.F.R. 1.8

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November 2, 2004
Date

Christina Hartline

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 1.191 AND 1.192

This Appeal Brief is being filed in furtherance to the Notice of Appeal faxed to the United States Patent and Trademark Office on September 2, 2004, and received by the Patent Office on September 2, 2004.

1. REAL PARTY IN INTEREST

The real party in interest is Global Electric Company, the Assignee of the above-referenced application by virtue of the Assignment recorded at reel 012739, frame 0557, on May 29, 2002. Global Electric Company, the Assignee of the above-referenced application, as evidenced by the documents mentioned above, will be directly affected by the Board's decision in the pending appeal.

11/09/2004 HALI11 00000052 070868 10063950
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Appeal Brief Fee and General Authorization for Extensions of Time

The Commissioner is authorized to charge the requisite fee of $340.00, and any additional fees which may be required, to Account No. 07-0868, Order No. 124463-2/YOD (GERD:0374). Further, in accordance with 37 C.F.R. § 1.136, Appellants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefore, which may be charged to the Deposit Account referenced above.

Respectfully submitted,

Date: November 2, 2004

Brent R. Knight

Brent R. Knight
Reg. No. 54,226
FLETCHER YODER
P.O. Box 692289
Houston, TX 77269-2289
(281) 970-4545

8. CLAIMS APPENDIX

1. An apparatus for detecting a hot rail car surface comprising:

an infrared sensor for acquiring an infrared signal from a rail car surface of a rail car and transducing said infrared signal into an electrical signal;

a rank filter for filtering said electrical signal to produce a filtered array;

a first peak detector for detecting a maximum filtered value of said filtered array; and

a first comparator for comparing said maximum filtered value to a detection threshold to produce a filtered alarm signal.

2. The apparatus of claim 1 wherein said rank filter has a rank of about one-half.

3. The apparatus of claim 1 further comprising:

a wireless transceiver for acquiring rail car surface characteristics from a wireless tag mounted on said rail car; and

a filter parameter calculator for calculating a filter length and rank of said rank filter as a function of said rail car surface characteristics.

4. (Original) The apparatus of claim 1 further comprising:

an unfiltered signal buffer for buffering said electrical signal to produce an unfiltered array;

a second peak detector for detecting a maximum unfiltered value of said unfiltered array;

a second comparator for comparing said maximum unfiltered value to said detection threshold to produce an unfiltered alarm signal; and

an alarm comparator for comparing said unfiltered alarm signal to said filtered alarm signal to produce a censored false alarm signal.

5. The apparatus of claim 4 wherein:

said censored false alarm signal comprises a binary signal having a true value when said unfiltered alarm signal differs from said filtered alarm signal and a false value otherwise; and

said apparatus further comprises a counter for counting said false values to produce a censored false alarm count.

6. The apparatus of claim 5 further comprising a failure isolator for diagnosing a failure mode from said censored false alarm count.

7. An apparatus for detecting a hot rail car surface comprising:

an infrared sensor for acquiring an infrared signal from a rail car surface of a rail car and transducing said infrared signal into an electrical signal;

a rank filter for filtering said electrical signal to produce a filtered array;

a first peak detector for detecting a maximum filtered value of said filtered array;

a first comparator for comparing said maximum filtered value to a detection threshold to produce a filtered alarm signal;

a wireless transceiver for acquiring rail car surface characteristics from a wireless tag mounted on said rail car;

a filter parameter calculator for calculating a filter length and rank of said rank filter as a function of said rail car surface characteristics;

an unfiltered signal buffer for buffering said electrical signal to produce an unfiltered array;

a second peak detector for detecting a maximum unfiltered value of said unfiltered array;

a second comparator for comparing said maximum unfiltered value to said detection threshold to produce an unfiltered alarm signal; and

an alarm comparator for comparing said unfiltered alarm signal to said filtered alarm signal to produce a censored false alarm signal.

8. The apparatus of claim 7 wherein:

said censored false alarm signal comprises a binary signal having a true value when said unfiltered alarm signal differs from said filtered alarm signal and a false value otherwise; and

said apparatus further comprises a counter for counting said false values to produce a censored false alarm count.

9. The apparatus of claim 8 further comprising a failure isolator for diagnosing a failure mode from said censored false alarm count.

10. A method for detecting hot rail car surfaces, the method comprising:

acquiring an infrared signal from a rail car surface of a rail car;

transducing said infrared signal into an electrical signal;

filtering said electrical signal using a rank filter to produce a filtered array; detecting a maximum filtered value of said filtered array; and

comparing said maximum filtered value to a detection threshold to produce a filtered alarm signal.

11. The method of claim 10 wherein said rank filter has a rank about one-half.

12. The method of claim 10 further comprising:

acquiring rail car surface characteristics from a wireless tag mounted on said rail car; and

calculating a filter length and rank of said rank filter as a function of said rail car surface characteristics.

13. The method of claim 10 further comprising:

buffering said electrical signal to produce an unfiltered array;

detecting a maximum unfiltered value of said unfiltered array;

comparing said maximum unfiltered value to said detection threshold to produce an unfiltered alarm signal; and

comparing said unfiltered alarm signal to said filtered alarm signal to produce a censored false alarm signal.

14. The method of claim 13 wherein:

said censored false alarm signal comprises a binary signal having a true value when said unfiltered alarm signal differs from said filtered alarm signal and a false value otherwise; and

said method further comprises counting said false values to produce a censored false alarm count.

15. The method of claim 14 further comprising diagnosing a failure mode from said censored false alarm count.

16. A method for detecting hot rail car surfaces, the method comprising:

acquiring an infrared signal from a rail car surface of a rail car;

transducing said infrared signal into an electrical signal;

filtering said electrical signal using a rank filter to produce a filtered array;

detecting a maximum filtered value of said filtered array;

comparing said maximum pictured value to a detection threshold to produce a filtered alarm signal;

acquiring rail car surface characteristics from a wireless tag mounted on said rail car;

calculating a filter length and rank of said rank filer as a function of said rail car surface characteristics;

buffering said electrical signal to produce an unfiltered array;

detecting a maximum unfiltered value of said unfiltered array;

comparing said maximum unfiltered value to said detection threshold to produce an unfiltered alarm signal; and

comparing said unfiltered alarm signal to said filtered alarm signal to produce a censored false alarm signal.

17. The method of claim 16 wherein:

said censored false alarm signal comprises a binary signal having a true value when said unfiltered alarm signal differs from said filtered alarm signal and a false value otherwise; and

said method further comprises counting said false values to produce a censored false alarm count.

18. The method of claim 17 further comprising diagnosing a failure mode from said censored false alarm count.

2. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. STATUS OF CLAIMS

Claims 7-9 and 16-18 are allowed. Claims 2-6 and 11-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Claims 1 and 10 are currently under final rejection and, thus, are the subject of this appeal.

4. STATUS OF AMENDMENTS

The Appellants have not submitted any amendments subsequent to the Final Office Action mailed on May 6, 2004.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates generally to the field of detecting excessively hot rail car surfaces. *See* Application, page 1, paragraph 0001. More particularly, the invention relates to the use of a rank filters to process infrared signals emitted by rail car surfaces. *See id.*

Malfunctioning rail car wheel bearings radiate heat due to friction. *See* Application, page 1, paragraph 0003. Accordingly, hot bearing detectors (HBD's) are deployed to detect over heated bearings in attempt to warn the operator to stop the train prior to derailment. *See id.* The HBD's utilize pyroelectric infrared sensors to detect heat profiles of the railcar wheel bearings as a railcar rolls past the sensor. *See id.* However, the sensors are affected by sensed sound and vibrations, which introduces undesirable noise on the electrical signals, known as "microphonic artifacts." *See id.* These microphonic artifacts may induce false alarms that result in stopping of the train unnecessarily, which costs the railroad significant time and money. *See id.*

Appellants provide a technique for detecting a hot railcar surface in a manner to reduce potential false alarms. In the present technique, a rank filter is utilized to process electrical signals to produce a filtered array. *See* Application, page 2, paragraph 0006. Specifically, in one embodiment, infrared sensor 110 may be coupled to a rank filter 140 and an unfiltered signal buffer 200. *See* Application, page 2, paragraph 0010. The infrared sensor 110 may comprise any electrical or electronic device capable of converting infrared electro-magnetic radiation into electrical signals. *See* Application, page 3, paragraph 0013. The filtered array 145 is passed from the rank filter 140 to a peak detector 150 that determines a maximum filtered value 155. *See* Application, page 3, paragraph 0012. The maximum filtered value is compared to a detection threshold 165 to produce a filtered alarm signal. *See id.* Further, the electrical signals are provided through the unfiltered signal buffer 200 to a second comparator 220 to produce an unfiltered alarm signal. *See* Application, page 4, paragraph 0017. The unfiltered alarm signal is compared with the filtered alarm signal to determine if a false alarm has been prevented. Thus, the present technique may prevent specific microphonic artifact, as is shown in Figure 2, from causing false alarms. *See* Application, page 6, paragraph 0021.

With regard to the exemplary embodiment described in independent claim 1, discussions about the recited features of claim 1 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to an apparatus for detecting a hot rail car surface (e.g., 120). *See, e.g.*, Application, Fig. 1; pages 2-3, paragraph 0010 and page 3-4, paragraph 0013. The apparatus includes an infrared sensor (e.g., 110) for acquiring an infrared signal from a rail car surface (e.g., 120) of a rail car and transducing said infrared signal into an electrical signal. *See id.* Also, the apparatus includes a rank filter (e.g., 140) for filtering said electrical signal to produce a filtered array (e.g., 145). *See, e.g.*, Application, Fig. 1; page 2, paragraph 0010 to page 4, paragraph 0015. Further, the apparatus includes a first peak detector (e.g., 150) for detecting a maximum filtered value (e.g., 155) of said

filtered array (e.g., 145), and a first comparator (e.g., 160) for comparing said maximum filtered value (e.g., 155) to a detection threshold (e.g., 165) to produce a filtered alarm signal. *See, e.g.*, Application, Fig. 1; page 3, paragraph 0012 to page 4, paragraph 0013.

With regard to the exemplary embodiment described in independent claim 10, discussions about the recited features of claim 10 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a method for detecting a hot rail car surfaces (e.g., 120). *See, e.g.*, Application, Fig. 1; pages 2-3, paragraph 0010 and page 3-4, paragraph 0013. The method includes acquiring an infrared signal from a rail car surface (e.g., 120) of a rail car. *See id.* The claim also recites transducing said infrared signal into an electrical signal. *See id.* The method also includes filtering said electrical signal using a rank filter (e.g., 140) to produce a filtered array (e.g., 145) and detecting a maximum filtered value (e.g., 155) of said filtered array (e.g., 145). *See, e.g.*, Application, page 2, paragraph 0010 to page 4, paragraph 0015. Finally, the method includes comparing said maximum filtered value (e.g., 155) to a detection threshold (e.g., 165) to produce a filtered alarm signal. *See, e.g.*, Application, page 3, paragraph 0012 to page 4, paragraph 0013.

6. <u>GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL</u>

Appellants respectfully urge the Board to review and reverse the Examiner's ground of rejection of claims 1 and 10 under 35 U.S.C. § 103(a) as being rendered obvious by U.S. Patent No. 5,331,311 to Doctor ("the Doctor reference") in view of an obvious manner of engineering choice.

7. <u>ARGUMENT</u>

Essentially, the Examiner rejected claims 1 and 10 under 35 U.S.C. § 103(a) as being unpatentable over the Doctor reference in view of accepted engineering practices.

While the Examiner rejected each of the independent claims 1 and 10 under the same proposed combination of prior art, each of these independent claims will be discussed separately below. Accordingly, Appellants respectfully request the Board overturn the rejection.

A. Legal Precedent

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes all of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

B. Overview

The present application includes independent claims 1 and 10. Each of the independent claims 1 and 10 includes recitations relating to *filtering electrical signals to produce a filtered array in a rank filter* and *detecting a maximum filtered value of the filtered array in a peak detector*, which are discussed in greater detail below. As support for such recitations, Appellants describe a technique for utilizing a rank filter 145 to process electrical signals to produce a filtered array 145. *See* Application, Fig. 1; page 2, paragraphs

0006 and 0010. A peak detector 150 determines a maximum filtered value 155 is detected and provided for further processing. *See id.* at Fig. 1; page 3, paragraph 0011 to paragraph 0013. Thus, the present technique may prevent specific microphonic artifact, which may be a result of sensed sound and vibrations, from causing false alarms. *See id.* at page 1, paragraph 0003; page 6, paragraph 0021. Accordingly, the present application describes a technique for detecting a hot rail car surface.

In contrast, the Doctor reference is directed to a detector of railroad wheels that may detect temperatures of hot wheel flanges and/or hot wheel bearings. *See* Doctor, col. 1, lines 7-11; col. 2, lines 10-20. In the Doctor reference, a detector housing 32 has a window 34 that faces a car 10 having wheels 14 and 16. *See id.* at Figs. 1, col. 2, line 58 to col. 3, line 5. The detector housing 32 includes a temperature sensor assembly 36 that includes a lens 54, an IR filter 56 and detectors 38-52. *See id.*, Fig. 2; col. 3, lines 7-18. The lens 54 focuses light associated with an image through the IR filter 56 to the detectors 38-52. *See id.* The detectors 38-52 are pyroelectric IR temperature sensing elements. *See id.* at col. 3, lines 9-11. The purpose of the IR filter 56 is clearly to deliver light to the detectors 38-52 at a wavelength capable of being detected by the elements. The detectors 38-52 convert the filtered light into electrical signals that are provided to the CPU 70 for analysis of various wheel conditions. *See id.* at Fig. 2; col. 3, lines 34-40. As a result, the each of the detectors 38-52 provides a waveform with various peaks 96, 98 and 100 that depict the temperature of the wheel flange or the wheel hub to the CPU 70 in a specific zone. *See id.* at , Fig. 3; col. 3, lines 56-67.

C. <u>Claim 1 is Not Rendered Obvious by the Doctor Reference</u>

Independent claim 1 recites:

> An apparatus for detecting a hot rail car surface comprising:
>
> an infrared sensor for acquiring an infrared signal from a rail car surface of a rail car and transducing said infrared signal into an electrical signal;
>
> a rank filter for filtering said electrical signal to produce a filtered array;

> a first peak detector for detecting a maximum filtered value of said filtered array; and
>
> a first comparator for comparing said maximum filtered value to a detection threshold to produce a filtered alarm signal.

In the rejection of independent claim 1, the Examiner asserted that the Doctor reference discloses all of the recited features except that it does not specifically state that a rank filter is used or that a signal is compared to a threshold. In an attempt to cure the deficiencies, the Examiner asserted that using a rank filter in place of the IR filter 56 of Doctor would have been obvious in view of engineering practices. However, the Doctor reference, even in light of the standard engineering practices simply cannot render claim 1 obvious for at least two reasons. First, neither the Doctor reference nor engineering practices could possibly suffice to equate a rank filter with an IR filter. Secondly, the Doctor reference, even in view of engineering practices, does not disclose or teach "a first peak detector for detecting a maximum filtered value of said filtered array," as recited in claim 1.

1. The Doctor Reference Fails to Teach or Suggest *A Rank Filter for Filtering said Electrical Signal to Produce a Filtered Array*

First, the Doctor reference does not disclose or suggest "a rank filter for filtering said electrical signal to produce a filtered array," as recited in claim 1. As noted above, the Examiner equated the IR filter 56 of Doctor with the "rank filter" of claim 1. Further, the Examiner asserted that using a rank filter in place of the IR filter 56 of Doctor would have been an obvious manner of engineering choice. However, the Examiner has misconstrued the claimed subject matter and misapplied the Doctor reference against the instant claim.

As a preliminary matter, it should be noted that the term "rank filter," as recited in claim 1, clearly relates to signal processing, and not to any type of physical or radiation filter. As noted in a Response to Office Action mailed November 25, 2003, one of ordinary skill in the art knows that a rank filter is used to sort or rank gray values in some neighborhood of individual pixels, and replaces the center pixel

by some value in the sorted ranked list of gray values. This definition is consistent with the present application, which describes the rank filter in the following passage:

> The process of filtering using rank filter 140 comprises: incorporating a new sample of electrical signal 115 into data buffer; discarding the oldest sample in the data buffer; finding a rank value of the data buffer; and storing the rank value in filtered array 145. The length of the data buffer is referred to as the "filter length." The "rank" of the filter is a quantity between 0 and 1 and defines the fraction of the data buffer containing values smaller than the rank value. For example, if the rank equal 0.5, then the rank filter finds the median value of the data buffer; if the rank equal 0.8, then the rank filter finds the 80th percentile value (i.e., the smallest value greater than 80 percent of all the values); of the rank equals 0, then the rank filter finds the minimum value; and if the rank equals 1, then the rank filter finds the maximum value.
> Application, page 3, paragraph 0011.

Thus, the rank filter, which is described above, is clearly defined in the present application.

To begin, despite the Examiner's assertion, a "rank filter" is not functionally equivalent to the IR filter 56 of Doctor. In Doctor, the IR filter 56 receives an image of the wheel 16 through the lens 54. *See* Doctor, col. 3, lines 16-18. Then, the IR filter 56 blocks light outside the IR spectrum and allows the IR light to pass to the detectors 38-52. *See id.* Clearly, the IR filter 56 is not filtering *electrical signals*, but is *filtering light* that corresponds to the image of the wheel 16. In fact, the IR filter 56 is not even electrically coupled to any components in the reference. Further, the only function of the IR filter 56 performs is blocking light outside the IR spectrum. That is, the IR filter 56 does not produce a filtered array, but simply filters certain wavelengths of light to prevent them from passing to the detectors 38-52. As such, the IR filter 56 is not functionally equivalent to the "rank filter" because it does not interact with *electrical signals* and does not *produce a filtered array*.

Further, the Examiner's assertion about engineering choice is completely without basis. In the rejection, the Examiner stated that using a rank filter in place of the IR filter 56 of Doctor would have been an obvious manner of engineering choice. As the only support for this assertion, the Examiner stated that both provide the functionally equivalent result of generating an array of sensed values in order to determine a peak value. Appellants assert that those skilled in the art would simply never equate the physical radiation filter taught by Doctor with the rank filter claimed. Indeed, a rank filter would have no effect on the light delivered to the detectors 38-52 of Doctor, which is the very purpose of the IR filter 56 taught by Doctor. Conversely, the IR filter 56 would have absolutely no use in processing signals, as does the claimed rank filter. The only possible relationship between the two is the fortuitous common use of the word "filter." Beyond that, the two offer no basis for comparison whatsoever. One skilled in the art simply could never replace one by the other.

2. The Doctor Reference Fails to Teach or Suggest *A First Peak Detector for Detecting a Maximum Filtered Value of said Filtered Array*

The Doctor reference does not disclose or suggest "a first peak detector for detecting a maximum filtered value of said filtered array," as recited in claim 1. As noted above, the Examiner asserted that the CPU 70 of Doctor corresponds with "a first peak detector" of claim 1. However, despite the Examiner's assertions, the Doctor reference does not disclose the claimed subject matter.

To begin, the signal processing and analysis performed by the CPU 70 of Doctor does not include peak detection of a maximum filtered value of a filtered array, as recited in claim 1. The detectors 38-52, which are pyroelectric IR temperature sensing elements, provide electrical signals to a preamplifier 58, a hold stage 60, a second amplifier stage 62, a multiplexer 64, and an A/D converter. *See* Doctor, col. 3, lines 19-35. The CPU 70 receives these signals and analyzes the signals to generate various wheel condition indications, not a maximum value. *See id.* at col. 3, lines 36-40. Further, the signals generated by the detectors 38-52 are simply samples taken at a certain point in time with each detector 38-52 detecting the temperature for a specific zone. *See id.* at col. 3, lines 51-55. These signals

have various peaks, such as the two lateral peaks 96 and 98 and the central peak 100, that are based on the temperatures sensed by the individual detectors 38-52. From the two-dimensional profile in the waveforms, the CPU 70 is able to determine peaks associated with the wheel flange and wheel hub. *See id.* at col. 4, lines 1-9. That is, the CPU 70 analyzes the waveform to determine the individual peak locations, not the maximum filtered value of a filter array. Thus, the signal processing in the Doctor reference does not include *determining a maximum filtered value from a filter array.*

Accordingly, because the reference, even in view of engineering practice, fails to disclose *all* of the claimed elements of claim 1, the Doctor reference cannot support a *prima facie* case of obviousness. Therefore, independent claim 1 and its dependent claims are clearly patentable over Doctor.

D. <u>Claim 10 is Not Rendered Obvious by the Doctor Reference</u>

Independent claim 10 recites:

> A method for detecting hot rail car surfaces, the method comprising:
> acquiring an infrared signal from a rail car surface of a rail car;
> transducing said infrared signal into an electrical signal;
> filtering said electrical signal using a rank filter to produce a filtered array;
> detecting a maximum filtered value of said filtered array; and
> comparing said maximum filtered value to a detection threshold to produce a filtered alarm signal.

In the rejection of independent claim 10, as with claim 1, the Examiner asserted that the Doctor reference discloses all of the recited features except that it does not specifically state that a rank filter is used or that a signal is compared to a threshold. In an attempt to cure the deficiencies, the Examiner asserted that using a rank filter in place of the IR filter 56 of Doctor would have been an obvious manner of engineering choice.

Claim 10 is clearly patentable for the same reasons set forth above with respect to claim 1, and the arguments summarized there are herein incorporated by reference. In short, there is no basis in the reference or in the engineering practices for equating an IR filter with a rank filter. The two devices are simply not interchangeable and the methods based upon their use are not comparable.

Accordingly, because the reference, even in light of engineering practices, fails to disclose *all* of the claimed elements of claim 10, the reference cannot support a *prima facie* case of obviousness. Therefore, independent claim 10 and its dependent claims are believed to be patentable over Doctor.

CONCLUSION

In view of the above remarks, Appellants respectfully submit that the Examiner has provided no supportable position or evidence that claims 1 and 10 are obvious. Accordingly, Appellants respectfully request that the Board find claims 1 and 10 and the associated dependent claims patentable over the prior art of record and reverse all outstanding rejections.